CLAIMS:

Having thus described our invention, what we claim as new, and desire to secure by Letters Patent is

1. A proton beam target for generating gamma rays in response to an impinging proton beam, the proton beam target comprising:

a thin ^{13}C Diamond gamma reaction layer for generating the gamma rays therefrom; and

a stopping layer for mitigating transmission of the proton beam therethrough, the stopping layer being formed of a refractory metal which has a relatively high hydrogen solubility for dissolving implanted hydrogen atoms therewithin as a result of the impingement of the proton beam and which is chemically reactive with the ^{13}C Diamond gamma reaction layer for chemically bonding therewith, wherein thermal dissipation in said target under proton beam exposure is improved.

2. The proton beam target of claim 1, wherein the refractory metal is Tantalum.

3. The proton beam target of claim 4, wherein a braze alloy has a liquidus above 800°C.

4. The proton beam target of claim 4, wherein the thin ^{13}C Diamond gamma reaction layer is deposited on said stopping layer via a plasma assisted CVD process at a temperature below said braze alloy liquidus.

5. The proton beam target of claim 1, wherein the thin ^{13}C Diamond gamma reaction layer is less than about 1 μm thick.

6. The proton beam target of claim 1, wherein the stopping layer comprises a metal foil brazed to a surface of a cooling support fabricated from a low z, high thermal conductivity material.

7. The proton beam target of claim 6, wherein said cooling support dissipates heat energy away from the stopping layer, said stopping layer being attached to the cooling support and is interposed between the ^{13}C Diamond gamma reaction layer and the cooling support.

8. A proton beam target for generating gamma rays in response to an impinging proton beam, the proton beam target comprising:

a thin ^{13}C Diamond gamma reaction layer for generating the gamma rays therefrom; and

a stopping layer for mitigating transmission of the proton beam therethrough, wherein thermal dissipation in said target under proton beam exposure is improved.

9. The proton beam target of claim 8, wherein the stopping layer comprises a SiC substrate.

10. The proton beam target of claim 8, wherein the thin ^{13}C Diamond gamma reaction layer is deposited on said stopping layer via a plasma assisted CVD process.

11. The proton beam target of claim 8, wherein the thin ^{13}C Diamond gamma reaction layer is less than about 30 μm thick.

12. The proton beam target of claim 8, wherein the stopping layer comprises a SiC substrate brazed to a surface of a cooling support fabricated from a low z, high thermal conductivity material.

13. The proton beam target of claim 12, wherein said cooling support dissipates heat energy away from the stopping layer, said stopping layer being attached to the cooling support and is interposed between the ^{13}C Diamond gamma reaction layer and the cooling support.

14. A method of fabricating a proton beam target for generating gamma rays which are reflected therefrom in response to an impinging proton beam, the method comprising the steps of:

(a) forming a stopping layer of a refractory metal for mitigating transmission of the proton beam therethrough, the stopping layer having a relatively high hydrogen solubility for dissolving implanted hydrogen atoms therewithin as a result of the impingement of the proton bean; and

(b) attaching a thin ^{13}C Diamond gamma reaction layer to the stopping layer for generating the gamma rays therefrom in response to the impinging proton beam, said stopping layer being chemically reactive with the ^{13}C Diamond.

15. The method of claim 14, wherein the thin ^{13}C Diamond gamma reaction layer is attached to the stopping layer via a plasma assisted CVD process.

16. The method of claim 14, further comprising the step of:

(c) attaching the stopping layer onto a cooling support for dissipating heat energy away from the stopping layer.

17. The method of claim 16, wherein the stopping layer is attached to the cooling support via brazing.

18. A method of fabricating a proton beam target for generating gamma rays which are reflected therefrom in response to an impinging proton beam, the method comprising the steps of:

(a) forming a stopping layer comprising a SiC substrate for mitigating transmission of the proton beam therethrough; and

(b) attaching a thin ^{13}C Diamond gamma reaction layer to the stopping layer for generating the gamma rays therefrom in response to the impinging proton beam, said stopping layer being chemically reactive with the ^{13}C Diamond.

19. The method of claim 18, wherein the thin ^{13}C Diamond gamma reaction layer is attached to the stopping layer via a plasma assisted CVD process.

20. The method of claim 18, further comprising the step of:

(c) attaching the stopping layer onto a cooling support for dissipating heat energy away from the stopping layer.

21. The method of claim 18, wherein the stopping layer is attached to the cooling support via brazing.

22. A contraband detection system comprising:

a means for producing a high energy beam of protons at a specific energy with a very narrow energy spread;

a proton beam target for generating gamma rays in response to impinging high energy beam of protons, said resultant gamma rays being preferentially absorbed by a targeted contraband material; and,

a plurality of detector means for detecting absorption of said gamma rays indicating presence of said targeted contraband material, wherein said proton beam target comprises:

a thin ^{13}C Diamond gamma reaction layer for generating the gamma rays therefrom; and

a stopping layer for mitigating transmission of the proton beam therethrough, the stopping layer being formed of a refractory metal which has a relatively high hydrogen solubility for dissolving implanted hydrogen atoms therewithin as a result of the impingement of the proton beam and which is chemically reactive with the ^{13}C Diamond gamma reaction layer for chemically bonding therewith, wherein thermal dissipation in said target under proton beam exposure is improved.

23. The contraband detection system of claim 22, wherein the means for producing a high energy beam of protons comprises a high current electrostatic accelerator.

24. The contraband detection system of claim 22, wherein the detector means for detecting absorption of said gamma rays comprises Bismuth Germinate (BGO) scintillator detectors.

25. A contraband detection system comprising:

a means for producing a high energy beam of protons at a specific energy with a very narrow energy spread;

a proton beam target for generating gamma rays in response to impinging high energy beam of protons, said resultant gamma rays being preferentially absorbed by a targeted contraband material; and,

a plurality of detector means for detecting absorption of said gamma rays indicating presence of said targeted contraband material, wherein said proton beam target comprises:

a thin ^{13}C Diamond gamma reaction layer for generating the gamma rays therefrom; and

a stopping layer comprising a SiC substrate for mitigating transmission of the proton beam therethrough, wherein thermal dissipation in said target under proton beam exposure is improved.

26. The contraband detection system of claim 25, wherein the means for producing a high energy beam of protons comprises an RF accelerator.

27. The contraband detection system of claim 22, wherein the detector means for detecting absorption of said gamma rays comprises nitrogenous liquid scintillator detectors.